AIRBNB BUSINESS MODEL ANALYSIS

BUSINESS MODEL CASE STUDY

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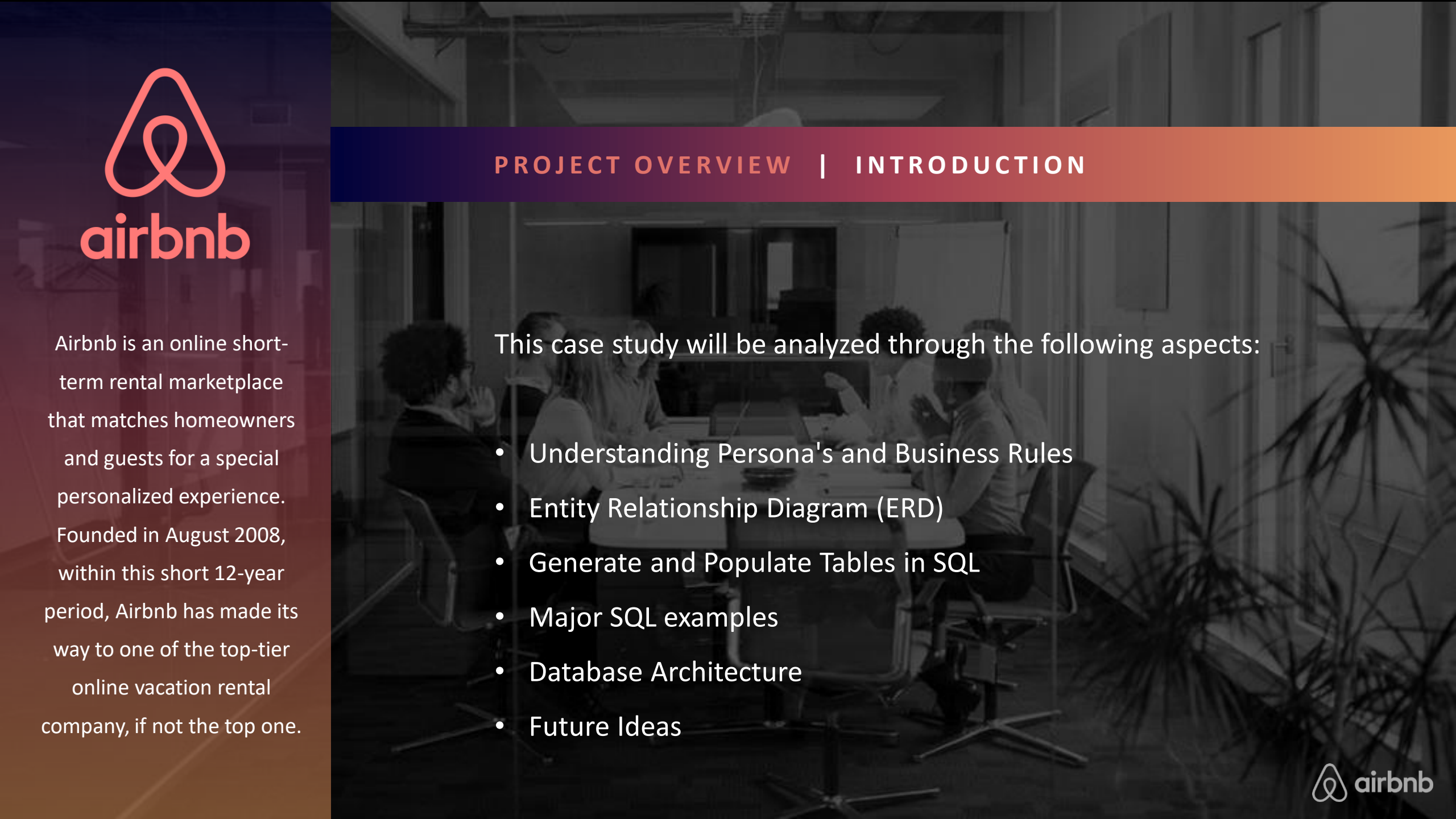

PROJECT OVERVIEW | INTRODUCTION

Airbnb is an online short-term rental marketplace that matches homeowners and guests for a special personalized experience. Founded in August 2008, within this short 12-year period, Airbnb has made its way to one of the top-tier online vacation rental company, if not the top one.

This case study will be analyzed through the following aspects:

- Understanding Persona's and Business Rules
- Entity Relationship Diagram (ERD)
- Generate and Populate Tables in SQL
- Major SQL examples
- Database Architecture
- Future Ideas

PERSONNAS AND BUSINESS RULES

6 MAJOR ENTITIES

HOST | LISTING | PROPERTY | GUEST | RESERVATION | REVIEW

9 BUSINESS RULES OF AIRBNB

- **Host to Property Relationship (1:M)**
  1 host owns 1 or many properties
- **Listing to Property Relationship (M:1)**
  1 or many listings associate with 1 property
- **Guest to Listing Relationship (1:M)**
  1 guest inquires about 1 or many listings
- **Listing to Reservation Relationship (1:1)**
  1 listing has 0 or 1 reservation
- **Host to Reservation Relationship (1:M)**
  1 host confirms to 1 or many reservations
- **Guest to Reservation Relationship (1:M)**
  1 guest makes 1 or many reservations
- **Guest to Review Relationship (1:M)**
  1 guest leaves/receives 0 or many reviews
- **Host to Review Relationship (1:M)**
  1 host leaves/receives 0 or many reviews
- **Property to Review Relationship (1:M)**
  1 property receives 0 or many reviews

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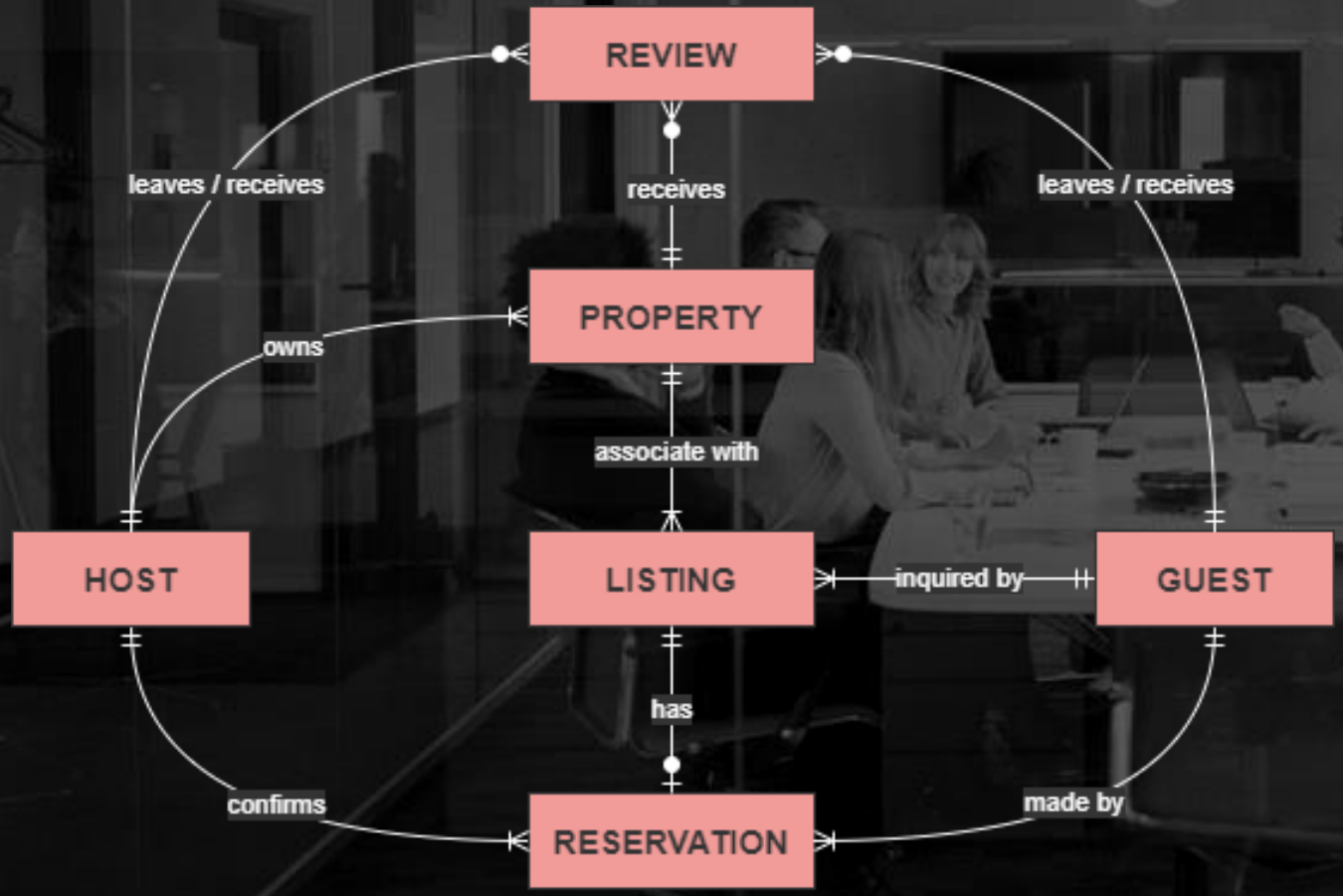
PERSONNAS AND BUSINESS RULES



ENTITIES AND ATTRIBUTES

HOST
Host ID, Host name, Email address, Phone num, Login credentials, Account info, etc.

LISTING
Availability, Min/Max stay days, Price, Refund type, Cancellation policy, etc.

PROPERTY
Property ID, Address, Images, Property type, Room types, Amenities, etc.

GUEST
Guest ID, Guest name, Email address, Phone num, Login credentials, Account info, etc.

RESERVATION
Check in/out dates, Number of people, Price paid, Receipt, etc.

REVIEW
Rating, Comment, etc.

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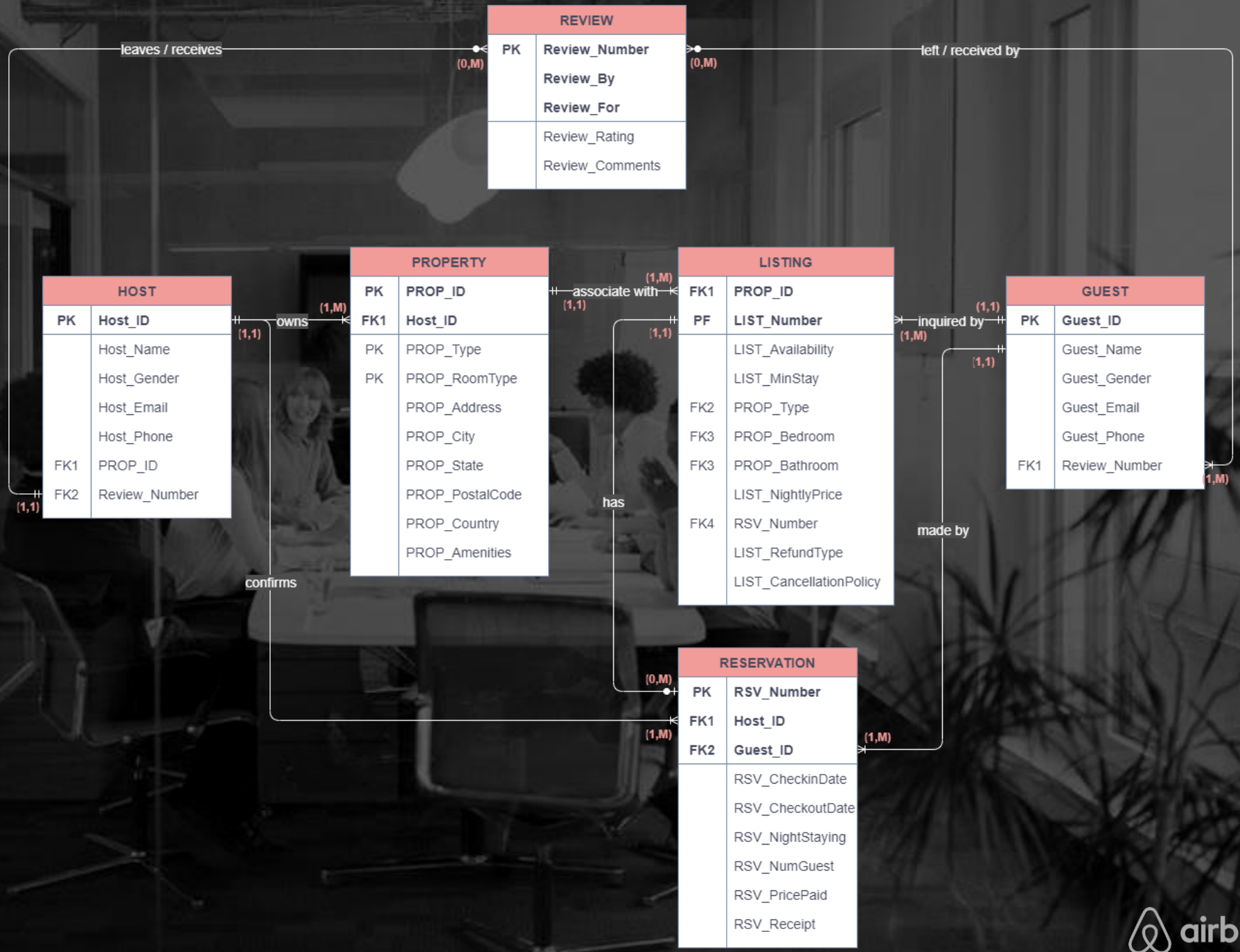
ENTITY RELATIONSHIP DIAGRAM (ERD)



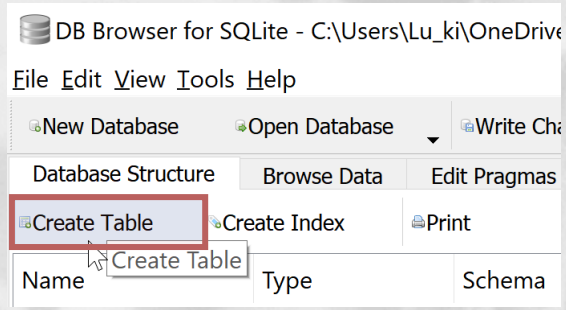
SQL APPLICATION | TABLE CREATION AND GENERATION

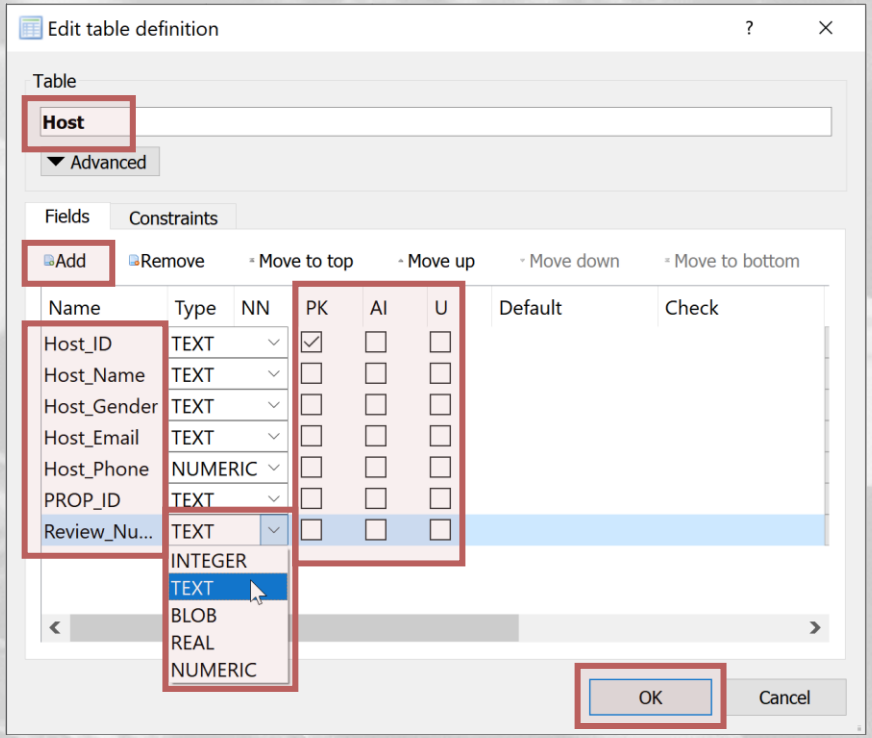
| METHOD 1 |

```
CREATE TABLE "Property" (
    "PROP_ID"    TEXT,
    "Host_ID"    TEXT,
    "PROP_Type" TEXT,
    "PROP_Bedroom"  INTEGER,
    "PROP_Bathroom" INTEGER,
    "PROP_Address"  TEXT,
    "PROP_City" TEXT,
    "PROP_State"    TEXT,
    "PROP_PostalCode"   NUMERIC,
    "PROP_Country"  TEXT,
    "PROP_Amenities"    TEXT,
    PRIMARY KEY("PROP_ID","PROP_Type",
    "PROP_Bedroom", "PROP_Bathroom")
);

CREATE TABLE "Listing" (
    "LIST_Number"   TEXT,
    "PROP_ID"    TEXT,
    "LIST_Availability" TEXT,
    "LIST_MinStay"  INTEGER,
    "PROP_Type" TEXT,
    "PROP_Bedroom"  INTEGER,
    "PROP_Bathroom" INTEGER,
    "LIST_NightlyPrice" INTEGER,
    "RSV_Number"    TEXT,
    "LIST_RefundType"   TEXT,
    "LIST_CancellationPolicy"   TEXT,
    PRIMARY KEY("LIST_Number")
);

CREATE TABLE "Review" (
    "Review_Number" TEXT,
    "Review_By" TEXT,
    "Review_For"    TEXT,
    "Review_Rating" INTEGER,
    "Review_Comments"   TEXT,
    PRIMARY KEY("Review_Number")
);
```

```
CREATE TABLE "Host" (
    "Host_ID"    TEXT,
    "Host_Name" TEXT,
    "Host_Gender"    TEXT,
    "Host_Email"    TEXT,
    "Host_Phone"    NUMERIC,
    "PROP_ID"    TEXT,
    "Review_Number" TEXT,
    PRIMARY KEY("Host_ID")
);

CREATE TABLE "Guest" (
    "Guest_ID"  TEXT,
    "Guest_Name"    TEXT,
    "Guest_Gender"  TEXT,
    "Guest_Email"   TEXT,
    "Guest_Phone"   NUMERIC,
    "Review_Number" TEXT,
    PRIMARY KEY("Guest_ID")
);

CREATE TABLE "Reservation" (
    "RSV_Number"    TEXT,
    "Host_ID"    TEXT,
    "Guest_ID"  TEXT,
    "RSV_CheckinDate"   TEXT,
    "RSV_CheckoutData"  TEXT,
    "RSV_NightStaying"  INTEGER,
    "RSV_NumGuest"  INTEGER,
    "RSV_PricePaid" INTEGER,
    "RSV_Receipt"   TEXT,
    PRIMARY KEY("RSV_Number")
);
```

| METHOD 2 |





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SQL APPLICATION | DATA INSERTION AND POPULATION

METHOD 1

```
INSERT INTO Host
VALUES ("H0001", "Jeffrey H.", "Male", "jh1@gmail.com", 4846674387, "P0001", "RV0001");
INSERT INTO Host
VALUES ("H0002", "David D.", "Male", "dd2@gmail.com", 3045893511, "P0002", "N/A");
INSERT INTO Host
VALUES ("H0003", "Kathy J.", "Female", "kj3@gmail.com", 6508846390, "P0003", "RV0003");
INSERT INTO Host
VALUES ("H0004", "Crystal M.", "Female", "cm4@gmail.com", 2136474983, "P0004", "RV0004");
INSERT INTO Host
VALUES ("H0005", "Tim Y.", "Male", "ty5@gmail.com", 4335983879, "P0005", "RV0005");
```

```
INSERT INTO Property
VALUES ("P0001", "H0001", "Entire Place", 3, 3.5, "60 E Colfax Ave", "Denver", "CO", 80203, "US", "Gym, Pool");
INSERT INTO Property
VALUES("P0002", "H0002", "Single Room", 0.5, 0.5, "2021 SW 4th Ave", "Portland", "OR", 97201, "US", "N/A");
INSERT INTO Property
VALUES("P0003", "H0003", "Entire Place", 2, 2, "600 5th Ave S", "Seattle", "WA", 98104, "US", "Jacuzzi");
INSERT INTO Property
VALUES("P0004", "H0004", "Studio", 1, 1, "260 King St", "San Francisco", "CA", 95107, "US", "Gym");
INSERT INTO Property
VALUES("P0005", "H0005", "Entire Place", 4, 3, "350 Hope Ave", "Salt Lake City", "UT", 84115, "US", "Jacuzzi, Balcony, Pool Table");
```

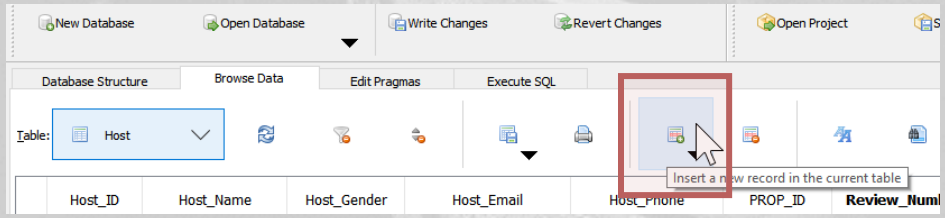
```
INSERT INTO Reservation
VALUES ("R0001", "H0001", "G0001", "Sep 3", "Sep 27", 24, 5, 13440, "RCPT01");
INSERT INTO Reservation
VALUES ("N/A", "H0002", "N/A", "N/A", "N/A", "N/A", "N/A", "N/A", "N/A");
INSERT INTO Reservation
VALUES ("R0003", "H0003", "G0003", "Aug 20", "Aug 23", 3, 4, 1035, "RCPT03");
INSERT INTO Reservation
VALUES ("R0004", "H0004", "G0004", "Dec 22", "Dec 30", 8, 2, 1488, "RCPT04");
INSERT INTO Reservation
VALUES ("R0005", "H0005", "G0005", "Jun 3", "Jun 18", 15, 6, 9375, "RCPT05");
```

```
INSERT INTO Listing
VALUES ("L0001", "P0001", "Jul 8 - Dec 31", 3, "Entire Place", 3, 3.5, 560, "R0001", "50%", "Strict");
INSERT INTO Listing
VALUES ("L0002", "P0002", "Jan 20 - Mar 18, June 1 - Aug 25, Nov 11 - Dec 15", 2, "Single Room", 0.5, 0.5, 89, "N/A", "100%", "Flexible");
INSERT INTO Listing
VALUES ("L0003", "P0003", "Mar 5 - Aug 26", 2, "Entire Place", 2, 2, 345, "R0003", "100%", "Flexible");
INSERT INTO Listing
VALUES ("L0004", "P0004", "Dec 20 - Dec 31", 1, "Studio", 1, 1, 186, "R0004", "75%", "Moderate");
INSERT INTO Listing
VALUES ("L0005", "P0005", "May 3 - Jul 29, Nov 27 - Dec 30", 5, "Entire Place", 4, 3, 625, "R0005", "50%", "Strict");
```

```
INSERT INTO Guest
VALUES ("G0001", "Kristine L.", "Male", "kl1@gmail.com", 6568430574, "RV0001");
INSERT INTO Guest
VALUES ("N/A", "N/A", "N/A", "N/A", "N/A", "N/A");
INSERT INTO Guest
VALUES ("G0003", "Jennie D.", "Female", "jd3@gmail.com", 4859063541, "RV0003");
INSERT INTO Guest
VALUES ("G0004", "Jackie F.", "Female", "jf4@gmail.com", 3880473980, "RV0004");
INSERT INTO Guest
VALUES ("G0005", "Chungfung C.", "Male", "cc5@gmail.com", 2056774518, "RV0005");
```

```
INSERT INTO Review
VALUES ("RV0001", "Kristine L.", "Jeffrey H.", 5, "Jeffrey was super helpful helping us settling in. We loved his place too!");
INSERT INTO Review
VALUES ("N/A", "N/A", "N/A", "N/A", "N/A");
INSERT INTO Review
VALUES ("RV0003", "David D.", "Jennie D.", 5, "It was great to have Jennie, look forward to host her again in the furture.");
INSERT INTO Review
VALUES ("RV0004", "Jackie F.", "Crystal M.", 4.5, "N/A");
INSERT INTO Review
VALUES ("RV0005", "Chungfung C.", "Tim Y.", 5, "We had a wonderful stay, Tim's house is such a greate place, clean and spacious.");
```

METHOD 2



	Host_ID	Host_Name	Host_Gender	Host_Email	Host_Phone	PROP_ID	Review_Number
	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	H0001	Jeffrey H.	Male	jh1@gmail.com	4846674387	P0001	RV0001
2	H0002	David D.	Male	dd2@gmail.com	3045893511	P0002	N/A
3	H0003	Kathy J.	Female	kj3@gmail.com	6508846390	P0003	RV0003
4	H0004	Crystal M.	Female	cm4@gmail.com	2136474983	P0004	RV0004
5	H0005	Tim Y.	Male	ty5@gmail.com	4335983879	P0005	RV0005

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SQL EXECUTION | MAJOR EXAMPLES

EXAMPLE – 1

QUERY 1 |

To find places that have more than 1 bedroom and are entirely available, also have a no more than 3 days of minimum stay.

SOLUTION 1 |

```
SELECT *
FROM(SELECT Property.*, Listing.LIST_MinStay
     FROM Property
     LEFT JOIN Listing
     ON (Property.PROP_ID = Listing.PROP_ID)
     )
WHERE PROP_Type = 'Entire Place'
     AND PROP_Bedroom > 1
     AND NOT LIST_MinStay > 3;
```

RESULT 1 |

	PROP_ID	Host_ID	PROP_Type	PROP_Bedroom	PROP_Bathroom	PROP_Address	PROP_City	PROP_State	PROP_PostalCode	PROP_Country	PROP_Amenities	LIST_MinStay
1	P0001	H0001	Entire Place	3	3.5	60 E Colfax Ave	Denver	CO	80203	US	Gym, Pool	3
2	P0003	H0003	Entire Place	2	2	600 5th Ave S	Seattle	WA	98104	US	Jacuzzi	2

EXAMPLE – 2

QUERY 2 |

To list all places in Salt Lake City, and check their rooms type, availability, price, refund type, as well as cancellation policy.

SOLUTION 2 |

```
SELECT Property.PROP_ID, PROP_Address, PROP_City,
     Property.PROP_Type, Property.PROP_Bedroom,
     Property.PROP_Bathroom, LIST_Availability,
     LIST_NightlyPrice, LIST_RefundType, LIST_CancellationPolicy
FROM(Listing
     JOIN Property
     ON (Listing.PROP_ID = Property.PROP_ID)
     )
WHERE PROP_City = 'Salt Lake City';
```

RESULT 2 |

	PROP_ID	PROP_Address	PROP_City	PROP_Type	PROP_Bedroom	PROP_Bathroom	LIST_Availability	LIST_NightlyPrice	LIST_RefundType	LIST_CancellationPolicy
1	P0005	350 Hope Ave	Salt Lake City	Entire Place	4	3	May 3 - Jul 29, Nov 27 - Dec 30	625	50%	Strict

SQL EXECUTION | MAJOR EXAMPLES

EXAMPLE – 3

QUERY 3 | To find places that have gym and does not have strict cancellation policy.

SOLUTION 3 |

```
SELECT *
FROM(SELECT Property.*, Listing.LIST_CancellationPolicy
    FROM Property
    LEFT JOIN Listing
    ON (Property.PROP_ID = Listing.PROP_ID)
    )
WHERE PROP_Amenities LIKE '%Gym%'
    AND NOT LIST_CancellationPolicy = 'Strict';
```

RESULT 3 |

	PROP_ID	Host_ID	PROP_Type	PROP_Bedroom	PROP_Bathroom	PROP_Address	PROP_City	PROP_State	PROP_PostalCode	PROP_Country	PROP_Amenities	ST_CancellationPoli
1	P0004	H0004	Studio	1	1	260 King St	San Francisco	CA	95107	US	Gym	Moderate

EXAMPLE – 4

QUERY 4 | To filter male hosts who have a rating of 5, list their properties along as well.

SOLUTION 4 |

```
SELECT *
FROM(SELECT Host.Host_ID, Host.Host_Name,
    Host.Host_Gender, Review.Review_Rating
    FROM Host
    JOIN Review
    ON (Host.Review_Number = Review.Review_Number)
    ) AS Host_Rating
LEFT JOIN Property
ON (Host_Rating.Host_ID = Property.Host_ID)
WHERE Host_Gender = 'Male'
    AND Review_Rating = 5;
```

RESULT 4 |

	Host_Name	Host_Gender	Review_Rating	PROP_ID	PROP_Type	)P_Bedro	)P_Bathro	PROP_Address	PROP_State	'_Postal	PROP_Country	PROP_Amenities
1	Jeffrey H.	Male	5	P0001	Entire Place	3	3.5	60 E Colfax Ave	CO	80203	US	Gym, Pool
2	Tim Y.	Male	5	P0005	Entire Place	4	3	350 Hope Ave	UT	84115	US	Jacuzzi, Balcony, Pool Table

SQL EXECUTION | MAJOR EXAMPLES

EXAMPLE – 5

QUERY 5 |

To find places that are available sometime in December and has a nightly price that is lower than 500, and rank by nightly price from low to high.

SOLUTION 5 |

```
SELECT *
FROM(SELECT Property.*, Listing.LIST_Availability, Listing.LIST_MinStay,
    Listing.LIST_NightlyPrice,Listing.LIST_CancellationPolicy
    FROM Property
    LEFT JOIN Listing
    ON (Property.PROP_ID = Listing.PROP_ID)
    )
WHERE LIST_Availability LIKE '%Dec%'
    AND LIST_NightlyPrice < 500
ORDER BY LIST_NightlyPrice ASC;
```

RESULT 5 |

	PROP_ID	PROP_Type	_Bed	_Bath	PROP_Address	PROP_City	OP_Sta	OP_Coun	P_Amen	LIST_Availability	_Min	_Nightly	Cancellation
1	P0002	Single Room	0.5	0.5	2021 SW 4th Ave	Portland	OR	US	N/A	Jan 20 - Mar 18, June 1 - Aug 25, Nov 11 - Dec 15	2	89	Flexible
2	P0004	Studio	1	1	260 King St	San Francisco	CA	US	Gym	Dec 20 - Dec 31	1	186	Moderate

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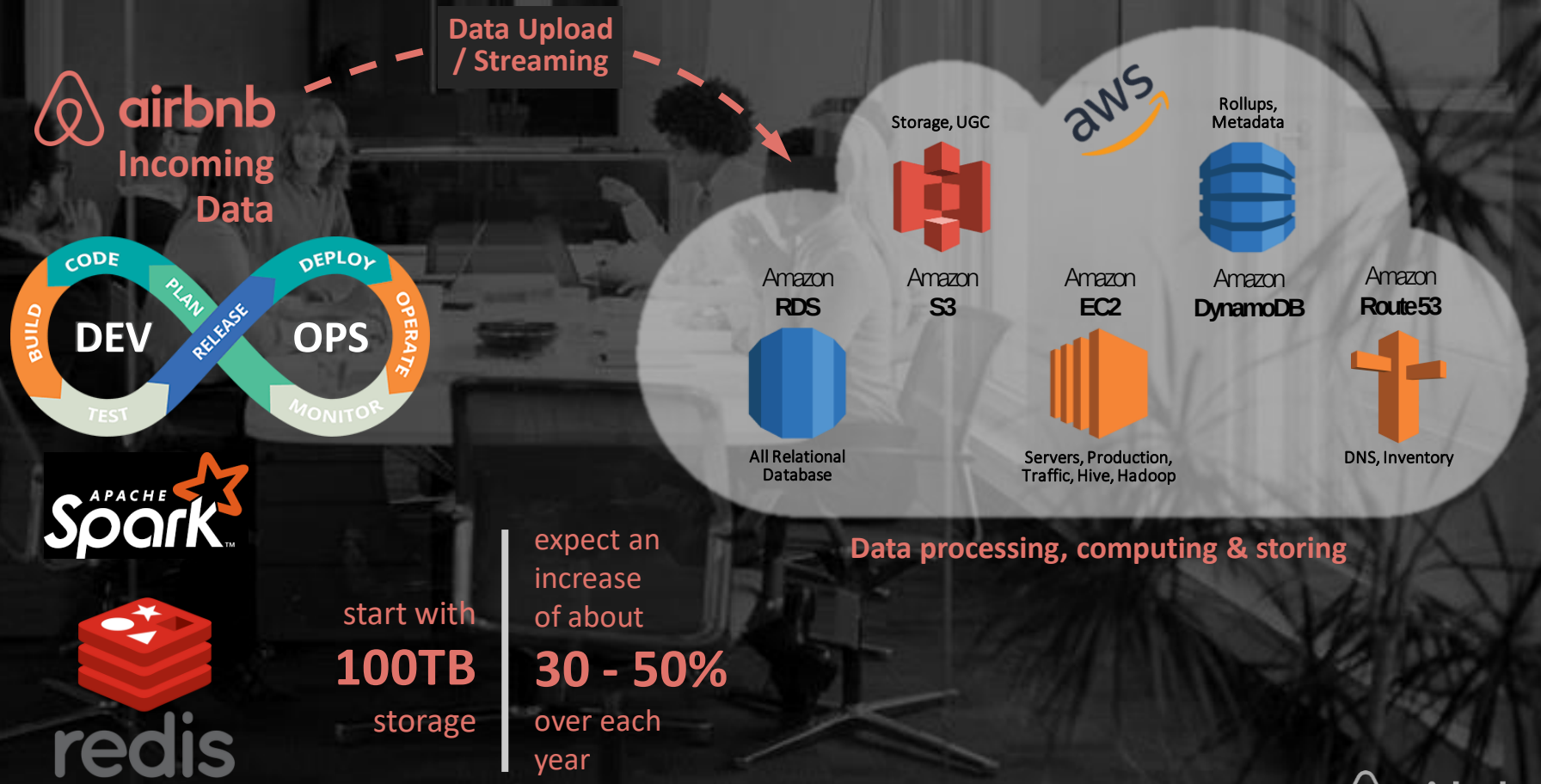
DATABASE ARCHITECTURE | DB CRITERIA AND INFRA OVERVIEW

Airbnb indeed generates and stores a humongous amount of data, and the size of the data is expected to continue grow in a fast pace and massive amounts. Also, besides structured data, there are also a tremendous amount of semi-structured/unstructured metadata, as well as relationship-related data that could be used to determine the preference of hosts and guest. Thus, some key criteria of the database architecture includes the ability to easy and seamless scaling, low administration and maintenance, and easy change management. All features above would allow the company to ramp up more servers as it continued to grow.

- ✓ **Cloud-based**
- ✓ **Decentralized**
- ✓ **Client/server databases**
- ✓ **Multi-model structured**

- Contains both **SQL/RDBMS** to store most of its structured data and all the confidential and sensitive information
- And a mixture of different types of **NoSQL/non-relational databases**, such as column-oriented and graph database, to store all other raw data, provide easy scaling and high availability, allow real-time access, and create data replications for fault-tolerances



start with **100TB** storage

expect an increase of about **30 - 50%** over each year

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FUTURE IDEA | NEXT STEP AND IMPROVEMENTS

Moving forward, the following things need to be kept in mind:

- Airbnb is a perfect example of a fast-growing company with ever-expanding Big Data needs. The ability to shift and adapt as the company has grown has, I think, been at the heart of its success. Consider implementing Big Data tools like Presto, Druid, or Airpal.
- To put more attention on Prediction and Machine Learning.
- More entities and attributes need to be added (images, activities, and much more).
- Consider using stratified data managing tools, such as Snowflake, where data computing is separated from data storing for faster computation. So it will make it even easier for Airbnb to expand its business to new regions and deploy its application globally in short period of time.

snowflake

presto

druid

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REFERENCES

Coronel, C., and Morris, S. Database Systems Design, Implementation, & Management 13th edition. (2016, Cengage Learning)

Steps of Developing Entity Relationship Diagrams (ERDs). http://users.csc.calpoly.edu/~jdalbey/205/Lectures/HOWTO-ERD.html

Define Business Rules Before Documenting Requirements for The Best Outcome. PERSPECTIVS. Sep 2, 2015. https://www.quickbase.com/blog/define-business-rules-before-documenting-requirements-for-the-best-outcome

Winters, C. Centralization Vs. Decentralization in Marketplaces and Scaling Companies. https://caseyaccidental.com/centralization-decentralization-marketplaces-and-scaling-companies/

Adamiak, C. (Dec. 4, 2019). Current state and development of Airbnb accommodation offer in 167 countries. https://www.tandfonline.com/doi/full/10.1080/13683500.2019.1696758

Sheehy, M. (July 24, 2015). There's an AWS database solution for just about any project you can imagine: the trick is properly understanding the job each of them does best. https://cloudacademy.com/blog/aws-database-options/

Airbnb Case Study. Retrieved from https://aws.amazon.com/solutions/case-studies/airbnb-case-study/#:~:text=In%20addition%2C%20Airbnb%20moved%20its,tasks%20typically%20associated%20with%20databases.